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THE WESTERN HEMLOCK LOOPER IN CLATSOP COUNTY, OREGON IN 1944

By

R.L. Furniss

Entomologist

Forest Insect Laboratory
445 U.S. Court House
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INTRODUCTION

Upward of 40,000,000 board feet of timber was killed during 1944 in Clatsop County, Oreg., by the western hemlock looper (Ellopia fiscellaria var. lugubrosa Hulst). Thus, for the first time in twelve years this destructive insect is again causing a heavy loss oftimber in the Pacific Northwest. The situation warrants aggressive action to minimize the damage already done and to forestall even more serious damage that is threatened. It is the purpose of this report to record what is known about the outbreak, to review the habits of the insect, and to explore some of the possible courses of counteraction.

The western hemlock looper is a local variety of a species that is destructive to hemlock and fir stands from Newfoundland to the Pacific Coast. It is characterized by severe outbreaks of a few years duration and by rather extended intervening periods of marked quiescence. In forests of the Pacific slope, recorded damage by the looper has been very largely confined to the coastal fog belt from Tillamook County, Oreg., northward to southwestern British Columbia. The principal outbreaks on record are as follows:

1889 - 1891 -- The earliest known looper outbreak, and perhaps the most destructive, occurred during the years 1889 to 1891 in northern Tillamook and southern Clatsop Counties, Oreg. Precise information as to the extent of this outbreak is not available, but it is known to have centered about the Gods Valley Creek and Nehalem River drainages, not far from the present outbreak. Fire followed the loopers and contributed greatly to the total destruction. According to reports, a similar flare-up of the looper is supposed to have caused extensive killing of timber in Grays Harbor, Wash., while this early outbreak in Oregon was in progress.

1911 - 1914 -- During this period the looper killed much hemlock in Stanley Park, Vancouver, B. C. Quite likely it was destructive elsewhere at the same time, although there is no definite record to bear out this surmise.

1919 - 1921 -- Approximately 500,000,000 board feet of hemlock, Douglas-fir, and Sitka spruce was killed on some 22,000 acres in Tillamook County, Oreg., in the years 1919 to 1921. Areas in the Cook Creek, Salmonberry River, and Wilson River drainages were affected. Subsequently most of the dead timber was swept by the great Tillamook Fire.

1929 - 1932 -- Infestation on 50,000 acres in Pacific and Grays Harbor Counties, Wash., resulted in the death of about 200,000,000 board feet of hemlock timber during this four-year period. In reality two outbreaks ran concurrently on widely separated areas. Fully three-fourths of the damage was causedin Pacific County, principally about the mouth of the Naselle River. While this was going on, heavy mortality was also being caused in the coastal region on the mainland of southwestern British Columbia. During the 1929 to 1932 outbreaks airplane dusting against the looper was carried out effectively in Pacific County, Wash., and on three smaller projects in British Columbia. As a result of dusting with calcium arsenate in Pacific County, approximately 90,000,000 board feet of timber was saved from destruction.

THE CURRENT OUTBREAK

Origin

On October 23, 1943, Mr. W. F. McCulloch, Assistant State Forester, noted numerous looper adults along the Crown Zellerbach logging road in Section 30, Township 5 North, Range 9 West. Some ofthese adults were subsequently sent to the Forest Insect Laboratory in Portland and were identified as the hemlock looper. McCulloch did not observe any defoliation in the vicinity where he collected the moths. Local residents have since reported that in September and October 1943 moths of the looper were abundant on and near the area that became defoliated in 1944. Thus it is probable that the build-up began in 1943.

That an outbreak of the looper was in progress, was not definitely established until rather late in the 1944 season when men working in the woods began to note the loopers and the effects of their feeding. The situation was brought to the attention of the forestry staff of Crown Zellerbach Corporation which promptly called upon the Forest Insect Laboratory for advice. A few days later, on October 10, A.J.F. Brandstrom, Verne Davis, R. M. King, and K. W. Clark of Crown Zellerbach Corporation and Furniss of the Bureau of Entomology and Plant Quarantine made a general examination and found defoliation to be widespread in stands south of the Necanicum River. It was obvious that a serious condition existed and that the first step should be to determine the extent of infestation.

Survey of 1944

The forestry staff of Crown Zellerbach Corporation was ready to proceed at once with a survey of conditions on lands owned by that organization. Sampling methods were devised and field work was begun immediately following the initial examination. During October and November R.M. King and K.W. Clark made a 10 per cent cruise of 12,000 acres comprising the bulk of the area now known to be involved in the outbreak. They found that 1,969 acres were heavily infested. Results of their work form the principal statistical basis for estimates of damage as given in this report.

Since several ownerships were involved, the Bureau of Entomology and Plant Quarantine undertook to determine the overall limits of infestation. Aerial reconnaissance was the only practical method of approach, and so arrangements were made with the U.S. Army Air Forces and the U.S. Marine Corps whereby Furniss was enabled to make three flights (October 16 and 23 and November 18) which, in the aggregate, covered all suspected areas. Although conditions were by no means ideal during any of the flights, a complete picture of the situation was obtained after eight hours of flying time. This phase of the survey is considered important in that it excludes the possibility of unsuspected centers of infestation going undetected while attentions are directed elsewhere.

Extent of Damage

From all information at hand it is estimated that approximately 12,000 acres are infested in some degree and, of this acreage, 2,500 acres are heavily infested (see accompanying map). Infestation occurs in Townships 4, 5 and 6 North, Ranges 9 and 10 West, at elevations ranging from 100 to 1,800 feet. Approximately 40,000,000 board feet of timber has been killed outright and a great deal more has been affected by partial defoliation. Thus, it is evident that a salvage problem of considerable magnitude already exists. Not only this, but a grave fire hazard has been created and an even greater one is in prospect.

Losses are heaviest in draws and sheltered drainages that are protected from the direct force of westerly winds. Predominantly the affected stand is a mature one. In the virgin state it runs about 35,000 board feet per acre and is composed of about 80 per cent western hemlock, 15 per cent Sitka spruce, and 5 per cent western red cedar. On the rather extensive areas that have been

selectively logged for airplane spruce, the percentage of spruce is somewhat less and the total volume is correspondingly less. One relatively limited stand of 70- to 80-year-old hemlock has also been seriously infested, a somewhat unusual circumstance, for the looper seems to prefer mature timber. Young hemlocks, when growing as understory trees, have been killed, but no recently established second-growth on cutover areas has been observed to be infested. Such stands of young second-growth can be considered nonsusceptible for all practical purposes. On the 1,968 acres that King and Clark found to be heavily infested, 66 per cent of the hemlock, 8 per cent of the spruce, and 2 per cent of the western red cedar were killed by the looper in 1944.

SOME THINGS ABOUT THE LOOPER

Life Stages and Habits

Hemlock loopers, like many insects, have four stages in their life cycle; however, the only forms commonly seen are the adult moths and the larvae or loopers that cause the actual damage. Eggs and pupae are so inconspicuous that they normally escape detection even when severe outbreaks are in progress. Adults, larvae, and pupae are shown in the accompanying illustration.

Adults

Adults are rather fragile, buff-colored moths with a wing expanse of about 1½ inches. They first begin to appear early in September and continue to emerge from then on into October. Although a few living moths may be seen about the forest in early November, the bulk of the egg laying occurs from about mid-September to mid-October, depending somewhat upon local conditions. No adults of the hemlock looper overwinter; therefore, any similar appearing moths that are seen in spring or early summer are some other species that should not be confused with the looper.

Eggs

Eggs are about 1/64 of an inch long and are of a blue-green to gray-green color. They are laid singly or in small groups on the underside of tree needles, on twigs, branches, and main trunks, and especially in moss attached to tree trunks and branches. At the height of an outbreak they may occur attached to debris on the ground. Winter is passed in the egg stage. Hatching begins early in May and extends until about the second week of June.

Larvae

The young larvae tend to crawl upward, eating as they go. At first they do considerable incidental feeding on such things as huckleberry, salmonberry, salal, and even devil's club, thus causing the "open" effect that characterizes the understory of a stand where the hemlock looper is epidemic. As the larvae develop, they concentrate increasingly on coniferous foliage, especially that of hemlock. By the middle of July they have usually caused sufficient defoliation so that their presence is quite noticeable. The loopers approach maturity and the peak of their feeding by the end of the second week in August. By this time they are characteristic "spanworms" or measuring worms" about 1½ inches long and of variable greenish to brownish color with diamond-shaped markings on the back. Also, at this time the loopers do considerable moving about, both by crawling and by dropping on silken threads from the trees. On areas where trees were killed, there are from 200 to more than 400 mature larvae feeding upon the foliage above each square foot of forest floor. No wonder then, with so many creatures crawling about in search of food, that the woods soon become full of "webs" and barren of foliage! About the middle of August the first larvae transform into pupae. As pupation progresses, the amount of feeding decreases until it ceases about the middle of September when all larvae have transformed into pupae.

Pupae

The pupa or transition stage is a legless, non-feeding form intermediate between the larva and the moth. Pupae are about ½ inch long and are of a mottled yellowish or greenish-brown color. They occur in moss on tree trunks and branches, in matted foliage, in bark crevices, and in various out-of-the-way places both of forest vegetation and on the ground. Approximately one month is spent in the pupal stage and then life is begun all over with the moths emerging and laying eggs for another generation of loopers.

Natural Control

The question comes up of how these outbreaks happen to develop after many years when very few loopers are seen. No positive statement can be made to clear up this point. It is thought that certain unusual climatic conditions favorable for development of the looper occur from time to time. Or perhaps conditions unfavorable for the natural enemies of the looper may be the root of the trouble. At any rate, the looper doesobtain a temporary release

from the parasites, predators, and diseases that usually keep it in check. After several years, usually three of heavy defoliation, the looper is again brought under natural control.

ACTION PROGRAM

Two courses of action are open to reduce the effects of this outbreak. Through salvage, the damage that has been done, or that will be done, can be minimized. Through artificial control, threatened damage can be prevented or at least kept within economic bounds.

Salvage

If all the timber that has been killed and all that might be killed could be salvaged at a profit, there would be no need to consider artificial control. Actually much of the dead timber will be salvaged. Some of it is already being salvaged by the Crown Zellerbach Corporation. Practically all the 1944 kill can be utilized if salvage is immediately undertaken on all ownerships on such a scale as to insure removal of all dead trees within a year or two after their death. One favorable circumstance is that much of the affected area has already been opened to logging through the development of roads for the cutting of airplane spruce. Some of the smaller, more isolated areas probably can not be profitably opened in time to effect salvage, at least not under the present conditions of labor shortage. What can and will be done in the way of salvage is a matter that rests with the operators.

Artificial Control

When viewed from the entomological standpoint, the damage done in 1944 indicates that artificial control measures should be undertaken to supplement salvage. Whether such measures are economically sound depends upon the values to be protected, and here again the operators and timber owners are the ones to decide. In case the decision is made to proceed with control, a great many details will have to be worked out in order to insure success. Unless this is done reasonably in advance of the time when control should be undertaken, it would be better not to start upon a control project. A few, but not necessarily all of the problems to consider are discussed in the following paragraphs.

Organization and Planning

Primary essentials for a successful control project are an efficient control organization and adequate financial backing. Responsibility for carrying out the project should be clearly defined and sufficient authority should be given so that the necessary arrangements can be made in a prompt and orderly fashion. It is understood that the State Forester is taking the initial step of setting up a zone of infestation so that costs can be apportioned among the owners and so that state aid can be enlisted. What can be undertaken then will depend upon the cooperation that is developed. It is certain, however, that adequate financing will have to be assured reasonably soon if control is to be undertaken in 1945.

Methods

Under forest conditions, such as exist on the area in Clatsop County where the topography is broken, roads are few, and the trees are tall, the only feasible method of control is the application of insecticides from aircraft. Aerial dusting and spraying have both been used with success against forest defoliators. Against the hemlock looper in the West, only dusting has been tried. In the 1929-1932 outbreaks, dusting with calcium arsenate at the rate of about 20 pounds per acre gave relatively good results in large-scale practical control operations under coastal conditions. In recent years in the Eastern United States, concentrated sprays of various kinds applied from airplanes and autogiros have been used and found superior to dusts. In the present case, the possibility of spraying rather than dusting should be investigated.

Application of insecticides from the air is so new to forests of the West that detailed procedures still have to be worked out in each individual case. Some of the problems that require attention are considered in the following paragraphs.

Equipment

The airplane -- Among the many types of aircraft that have been developed in recent years there are probably some that would be outstandingly well suited for applying insecticides to forested areas. Whether the ideal one could be obtained for this project is another question. The basic need is for a slow-flying craft that is readily maneuverable and that will carry a large pay load. It would be well to investigate all possibilities for obtaining a suitable plane; however, the following three sources seem to offer the most promise:

(1) Certain commercial organizations have planes that are outfitted and used for the application of insecticides to orchards and to truck and field crops. Pilots hired by some of these companies are trained and highly skilled in work fairly comparable to, though far less hazardous than dusting a forested area. Both the planes and services of the pilots can be obtained under contract.

(2) If prior commitments in other parts of the country are not in conflict, it may be that a specially equipped plane can be obtained through the Bureau of Entomology and Plant Quarantine. Such a plane would offer the advantage of having the latest mechanism for application of insecticides and thereby another problem would be solved.

(3) Finally, there is the possibility that some branch of the armed services might consider the project a worthwhile training project for pilots concerned with chemical warfare and similar activities.

Other equipment -- Storing, loading, transporting, and applying insecticides require considerable equipment, some of which would have to be constructed on the spot. The exact nature of this equipment will be influenced by the type of application decided upon, the type and size of aircraft used, and a variety of other factors. Once control is decided upon, a start toward rounding up equipment should be made at an early date.

Insecticides

Arsenicals, at the rates normally applied, have the disadvantage of being bulky and thereby adding to the cost of control, since a great many flights are necessary in order to spread enough dust over large areas to insure good results. In addition, arsenicals are toxic to man, a fact to be considered in the present case, for much of the area lies within the watershed from which the City of Seaside obtains its water supply. Actually, what hazard there is lies in any adverse publicity that might accrue to the control project rather than in any real danger of poisoning. Nonetheless, in order to forestall public apprehension, it would be desirable to use some other insecticide.

Within the past year aerial application of DDT as a concentrated spray has proven outstandingly successful against many different forest defoliators in the Northeastern States. Presumably it would be similarly effective against the looper, although no actual tests have been carried out. This material, the use of which is still in the experimental stages and which is still largely reserved for military use, can be used much more sparingly than other materials that have been used to date. Thus, the use of DDT promises lessened control costs. The indications are that it is far less toxic to man than are the arsenicals. It is not known whether sufficient quantities of DDT could be made available for the project in Clatsop County.

Project Details

Time for control -- From mid-June to the end of June would be the ideal period during which to carry out control. By then, all the eggs will have hatched and feeding will be in progress, although not advanced sufficiently to have caused appreciable damage. Good control can be achieved as late as the middle of July; however, plans should not be laid for treating that late, for delays occasioned by the weather and other factors are unavoidable. Any delays at that time of year would very materially cut down the effectiveness of control.

Areas to be covered -- It is impossible now to tell with certainty what areas will be sufficiently affected in 1945 to warrant control. The likelihood is that the total infested area will far exceed the facilities available for control. In that case only the more seriously affected areas can be treated. Less seriously affected areas can be omitted on the assumption that a large percentage of the partially defoliated trees will recover unless they are subsequently reattacked. And, of course, areas on which salvage is practical can also be excluded from control plans. It is likely that much of next year's heavy infestation will be adjacent to the heavy centers of 1944, although some will probably show up in new places. In other words, one of the basic considerations is to determine what particular areas should be treated in 1945. This is a technical matter that the Bureau will undertake as soon as possible after the young larvae become active. Before control work is begun, it would be advantageous to build up an aerial mosaic covering all areas to be treated. Such a mosaic would greatly facilitate actual control operations.

Landing field -- Apparently a landing field will have to be improvised, for there is none nearer than the military field at Astoria, fifteen miles or more distant from most of the infested area. Some years ago the beach near Seaside was used by planes,

but it does not appear to be particularly well suited for that purpose. Perhaps the local golf course at Seaside could be used. One point is clear, the larger the plane the greater the problem will be of finding a suitable field.

Clearance for flights -- Because of restrictions on flying within the coastal defense area, clearance for flights connected with the project would have to be obtained from the Western Defense Command.

Project specifications -- When the method, materials, and other matters have been decided upon, job specifications should be outlined in detail. This is an essential if control is to be undertaken through contract with some private concern.

Costs

Costs of aerial dusting and spraying are widely variable, depending upon the size and nature of the project. In 1931 in Pacific County, Wash., 5,400 acres were dusted at $2.71 per acre. Costs on smaller projects have run about $6.00 to $8.00 per acre. At the present stage of planning little would be gained by hazarding a guess on the probable costs of control in Clatsop County. Needless to say, since control must pay its way, there are very definite cost limitations that will have to be considered in setting up plans for control.

PROSPECTS FOR 1945

One of the most important problems with regard to planning for salvage and control is to determine what the loopers will do in 1945, in 1946, and thereafter. Unfortunately, their actions can not be prophesied with certainty. Experience with past outbreaks indicates that there will be about two more seasons of heavy defoliation, with the peak probably occurring in 1945. Conditions in the fall of 1944 seemed favorable for continued development and increase of the loopers. Adults were extremely abundant over a wide area. Relatively high temperatures and extended periods of rainless weather during September and October were favorable for egg laying. Random observations on October 10 showed that up to that time very large numbers of eggs had been laid on the areas sampled.

Another factor that enters the picture is the possibility of spread of the outbreak to areas not yet affected, or at least not seriously so. No doubt mortality will continue on the area shown in red on the accompanying map; very likely much of the area shown in yellow will harbor heavy infestation in 1945; and quite likely some of the adjoining areas will become infested. New centers may also develop at considerable distances from the present outbreak. Areas that will bear special scrutiny include drainages of Klootchie Creek, Circle Creek and the South Fork of the Necanicum, and also several short drainages running northward into the Lewis and Clark River. Drainages emptying into the Nehalem to the south of Sugar Loaf Mountain and Onion Peak, as well as hemlock stands still farther southward, should also be kept under observation.

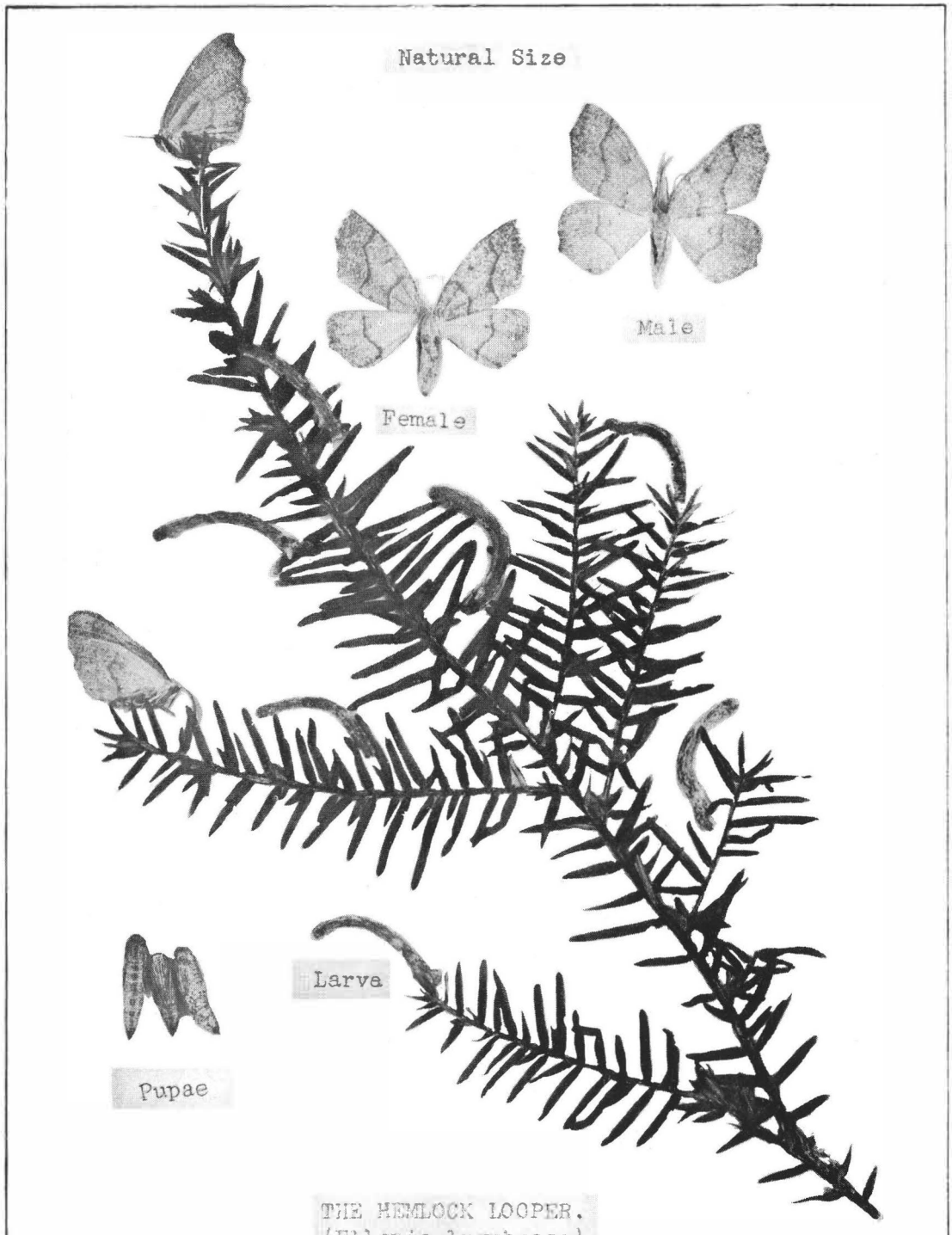
RECOMMENDATIONS

(1) It is suggested that every effort be made to obtain maximum salvage of the insect-killed timber, whether killed in 1944 or subsequently. An adequate salvage program will materially reduce needs for direct control.

(2) The possibilities of undertaking direct control in 1945 should be fully explored along the lines mentioned in this report.

(3) If control work is decided upon, project plans should be immediately drawn up and arrangements made so that the work can be carried out promptly and efficiently at the proper time.

(4) The course of infestation should be kept under close observation so that salvage and control can be kept in line with actual needs.



THE HEMLOCK LOOPER.
(Ellopia lugubrosa)

A destructive enemy of Douglas fir and Western hemlock

HEMLOCK LOOPER AREA
SEASON OF 1944

0 - 20% defoliation

21 - 100% defoliation

R.10W. R.9W.

T.6N. T.5N.

TO ASTORIA 20 MILES

SEASIDE

TILLAMOOK HEAD

Indian Beach

Ecola Pt.

Chapman Pt.

Cannon Beach

Haystack Rock

Tolovana Park

Silver Pt.

Sugarloaf

Beerman Creek

NEHALEM RIVER

LEWIS AND CLARK RIVER

SOUTH FORK

NORTH FORK

HATCHERY

FIRST

Bergsvik Creek